CLAIMS

1. A method for performing failure analysis on a semiconductor device under inspection, comprising:

preparing of a sample of the semiconductor device under inspection using an encapsulation material containing a dye, the prepared device sample possibly including at least one failure area containing wicked in encapsulation material containing the dye;

sectioning the prepared device sample to facilitate viewing a cross section face of the device under inspection; and

performing a dark field analysis on the prepared device sample with the use of dark field illumination, wherein responsive to at least one failure area containing wicked in encapsulation material with dye occurring on the cross section face of the device under inspection, the failure area can be readily identified as well as a contrast and perspective of remaining portions of the cross section face being maintained.

2. The method of claim 1, wherein the semiconductor device includes a wafer level chip scale packaged semiconductor device.

3. The method of claim 1, wherein the dye includes at least one fluorescent dye selected from the group consisting of a Xanthane, Naphthalimide, Perylene, Courmarin, and Fluorescein based family.

4. The method of claim 1, wherein the dye includes a dye pigment that is added to an uncured epoxy encapsulation material.

5. The method of claim 4, wherein preparing the device sample further includes placing the sample into a container along with the uncured epoxy containing the dye pigment, placing the same in a vacuum chamber, and maintaining the same under vacuum within the vacuum chamber for a duration of time sufficient for allowing the uncured epoxy encapsulation material containing dye to wick into a failure area of delamination extending from an exterior to an interior of the device sample.

6. The method of claim 5, further including configuring the conditions within the vacuum chamber to promote wicking of the encapsulation material containing dye into the failure area.

7. The method of claim 5, wherein preparing the device sample further includes employing a vacuum purge cycle subsequent to placing the device sample under vacuum within the vacuum chamber for the duration of wicking, allowing the dye and encapsulation material to return to standard ambient conditions, and then curing the encapsulation material containing the dye.

8. The method of claim 4, further wherein the encapsulation material includes a two component encapsulant comprised of a resin and a hardener.

9. The method of claim 1, wherein sectioning of the sample includes rough grinding, followed by fine grinding, and then polishing, prior to subjecting the sample to the dark field analysis.

10. The method of claim 1, wherein performing the dark field analysis includes capturing an image of the cross section of the prepared device sample under dark field illumination.

11. The method of claim 1, further wherein performing the dark field analysis includes using a compound microscope configured for dark field illumination and inspection and wherein the compound microscope includes an image capture system coupled to the compound microscope for capturing an image of the cross section face of the device under inspection.

12. The method of claim 11, wherein the captured image include a digital image.

13. The method of claim 1, wherein the dark field illumination includes use of a full complement of light for illuminating the cross section face of the device under inspection.

14. The method of claim 1, further comprising repeating the sectioning of the prepared device sample to facilitate viewing another cross-section face of the device under inspection, and performing dark field analysis on the another cross section face of the prepared device sample with the use of dark field illumination.

15. The method of claim 1, further comprising:

prior to preparing and sectioning the device sample, performing an initial assessment of the device under inspection with the use of acoustic scanning to determine a location for cross sectioning the device sample, the location corresponding to a

potential failure area or point of delamination in the device sample.

16. A method of manufacturing a semiconductor device comprising: fabricating the semiconductor device;

performing a failure analysis on the semiconductor device, the failure analysis including (a) preparing of a sample of the semiconductor device under inspection using an encapsulation material containing a dye, the prepared device sample possibly including at least one failure area containing wicked in encapsulation material containing the dye, (b) sectioning the prepared device sample to facilitate viewing a cross section face of the device under inspection, and (c) performing a dark field analysis on the prepared device sample with the use of dark field illumination, wherein responsive to at least one failure area containing wicked in encapsulation material with dye occurring on the cross section face of the device under inspection, the failure area can be readily identified as well as a contrast and perspective of remaining portions of the cross section face being maintained; and

adjusting the manufacturing process in response to an outcome of the failure analysis.

17. The method of claim 16, wherein the semiconductor device includes a wafer level chip scale packaged semiconductor device.

18. The method of claim 16, wherein the dye includes at least one fluorescent dye selected from the group consisting of a Xanthane, Naphthalimide, Perylene, Courmarin, and Fluorescein based family.

19. The method of claim 16, wherein the dye includes a dye pigment that is added to an uncured epoxy encapsulation material.

20. The method of claim 19, wherein preparing the device sample further includes placing the sample into a container along with the uncured epoxy containing the dye pigment, placing the same in a vacuum chamber, and maintaining the same under vacuum within the vacuum chamber for a duration of time sufficient for allowing the uncured epoxy encapsulation material containing dye to wick into a failure area of delamination extending from an exterior to an interior of the device sample.

21. The method of claim 16, further wherein performing the dark field analysis includes using a compound microscope configured for dark field illumination and inspection and wherein the compound microscope includes an image capture system coupled to the compound microscope for capturing an image of the cross section face of the device under inspection.

22. The method of claim 16, further comprising repeating the sectioning of the prepared device sample to facilitate viewing another cross-section face of the device under inspection, and performing dark field analysis on the another cross section face of the prepared device sample with the use of dark field illumination.

23. The method of claim 16, further comprising:

prior to preparing and sectioning the device sample, performing an initial assessment of the device under inspection with the use of acoustic scanning to determine a location for cross sectioning the device sample, the location corresponding to a potential failure area or point of delamination in the device sample.

24. A method for non-destructive testing in the manufacture of a device comprising:

adding a dye to a process component used in the manufacture of the device;

processing the device in the manufacturing process using the process component containing the dye;

inspecting the processed device under dark field illumination, wherein inspecting includes illuminating the processed device with dark field illumination and determining, in response to the applied dark field illumination, a presence or absence of the process component containing the dye; and

responsive to an inspection result of one of a desired presence or absence of the process component containing the dye, continuing with a next step in the manufacturing process of the device, otherwise, repeating the step of processing the device in the manufacturing process using the process component containing the dye until obtaining the desired presence or absence of the process component containing the dye.

25. The method of claim 24, wherein the device includes at least one selected from the group consisting of a semiconductor device and a printed circuit board.

26. The method of claim 24, wherein the dye includes at least one selected from the group consisting of a Xanthane, Naphthalimide, Perylene, Courmarin, and Fluorescein based family.

27. The method of claim 24, wherein the process component includes at least one selected from the group consisting of a photo resist, a solder mask, a bi-cycle butane, flux, and an organic passivation layer.

28. The method of claim 24, wherein determining a presence or absence of the process component containing the dye includes determining whether a residue of the process component on the order of several angstroms has been removed.

29. The method of claim 24, further wherein the inspection result indicates a failure of a desired outcome corresponding to a continued presence or absence of dye on a particular area of the device being manufactured, and wherein responsive to the failure, the process returns to the step of processing the process component.

30. The method of claim 24, further wherein the inspection result indicates achievement of a desired outcome corresponding to one of a continued presence or absence of dye on a particular area of the device being manufactured, and wherein responsive to the achievement of the desired outcome, the process proceeds with a next processing step in the continuation of the manufacturing process for the device under manufacture.